

rather than a pointed genital opening, in having the lateral margins of the genital plate longer than the anterior margins, in the setal arrangement of the anal plates, in that the posterior dorsal setae of femur II does not reach the base of the anterior seta, and in femur II

having an abrupt rather than a gentle posterior dorsal angle.

The type, U.S.N.M. no. 1515, and 10 paratypes, which were sent in by B. S. Chauhan and named for him, were collected from grass, Izatnagar (Bareilly), U. P., India.

ZOOLOGY.—*The West Pacific species of the molluscan genus Aforia.*<sup>1</sup> PAUL BARTSCH, U. S. National Museum.

In the preparation of a monograph on the East Pacific mollusks, recent and fossil, of the family Turridae, it became necessary to examine the congeneric elements dwelling in the western Bering Sea and the cold inshore waters of the Asiatic side of the Pacific. In the case of the genus *Aforia* I find that a much greater degree of specialization and differentiation has taken place in the Asiatic fauna than in American waters, as demonstrated by the present little monograph.

Genus *Aforia* Dall

1889. *Aforia*, Dall, Bull. Mus. Comp. Zool. 18: 99.

1908. *Aforia*, Dall, Bull. Mus. Comp. Zool. 43: 257.

Shell large, turreted, covered by a thin periostracum when perfect. Last whorl longer than the spire preceding it. Nucleus slender, multi-spiral, with the surface worn in all our specimens. A strong median keel is present on the middle of the postnuclear whorls. The deep anal notch falls halfway between the keel and the summit of the turns. The surface is marked by spiral lirations and fine incremental lines. Part of the adult shells bear a second fold, which begins on the middle of the last turn and gradually develops into a clawlike channel posterior to the anterior termination of the base. This is probably a sexual character. Columella long, attenuated, concave on the left side. Aperture large, elongate pear-shaped with the anterior half narrowed into a moderately wide channel; outer lip thin; inner lip sigmoid, forming a thin callus on the columella and parietal wall. Operculum narrow, thin, corneous, clawlike with lateral subapical nucleus marked by

low, concentric threads. Radula with rather large rachidian and Y-shaped marginals.

On the Asiatic side we find *Aforia insignis* (Jeffreys) south of St. Lawrence Island; from there the genus extends southward along the coast of Sakhalin Island in the Okhotsk Sea to the outside of Hokkaido and Honshu, and one species has been taken off the coast of Chosen.

KEY TO THE WEST PACIFIC SPECIES OF OOFRIA

Spiral cords on columella more than 50. .*japonica*

Spiral cords on columella less than 35.

Spiral cords on columella more than 30.

*diomedea*

Spiral cords on columella less than 20.

Spiral cords of penultimate whorl anterior to keel 18.

Spiral cords on keel very strong. *hondoana*

Spiral cords on keel not very strong.

*insignis*

Spiral cords of penultimate whorl anterior to keel, less than 16.

Adult shell large, more than 60 mm.

Base with 4 strong spiral cords.

*okhotsensis*

Base with 9 weak spiral cords.

*sakhalinensis*

Adult shell small, less than 46 mm.

*chosensis*

*Aforia japonica* (Dall)

Figs. 5, 6

1925. *Turricula japonica* Dall, Proc. U. S. Nat. Mus. 66: 29, pl. 26, fig. 11.

Shell of medium size, covered with a thin pale gray periostracum. The whorls bear a strong, slightly upturned, median keel, which is frequently split. Posterior to the keel the shell bears mere indications of microscopic spiral striations. Anterior to the keel, on all but the last whorl, there is no indication of spiral sculpture. On the last whorl, however, anterior

<sup>1</sup> Published by permission of the Secretary of the Smithsonian Institution. Received September 17, 1945.

to the keel, numerous, feebly incised, spiral lines are present, of which about 24 appear on the base and more than 50 on the columella. On the anterior fourth of the columella they disappear altogether. In addition to this, the base and columella are marked by strong incremental lines, which give to the surface a somewhat clothlike texture. Aperture extremely elongate-pyriform. Outer lip with a deeply incised sinus, having its greatest depth a little anterior to the middle between the keel and the summit. Anterior to the sinus the outer lip is protracted. Inner lip very elongate-sigmoid. The columella and parietal wall rendered smooth by resorption at the inner lip. The left outline of the base and columella is concavely slightly sigmoid.

The type, U.S.N.M. no. 205041, was dredged by the *Albatross* at station 5088 off Joka Sima Light in Sagami Bay, Honshu, Japan, in 369 fathoms; bottom temperature, 41.8°F., on green mud bottom. It has 8 whorls and measures: Height, 53 mm; greater diameter, 18.1 mm; length of last whorl, 34.3 mm.

U.S.N.M. no. 205038 contains a young specimen dredged by the *Albatross* at station 5093 off Joka Sima Light in 302 fathoms; bottom temperature, 43.9°F., on black sand and broken shell bottom.

This species can readily be distinguished from all the others by its extremely feeble sculpture of the base and columella.

***Aforia diomedea*, n. sp.**

Figs. 11, 12

Shell very large, rather narrow, elongate-turreted, covered with a pale gray, putty-colored periostracum. The whorls are encircled by a strong, up turned median keel. Posterior to the keel are 2 spiral threads and more microscopic spiral lines. The keel itself bears closely spaced spiral threads. Anterior to the keel 7 strong, rounded spiral cords are present between the summit of the last turn and the keel. These are a little broader than the spaces that separate them. Anterior to this the rest of the base and columella are marked by 40 incised grooves which separate rather flattened spaces of about the same width or a little wider than the grooves. Some of these bear one to three fine incised lines. In addition to this the entire base and columella are marked by incremental lines. Aperture elongate pear-shaped. Outer lip

with a deep sinus a little anterior to the middle between the summit and keel, protracted anteriorly to the keel. The inner lip is decidedly sinuous and by resorption causes the columella and parietal wall to appear as a glazed surface. The left side of the base and columella is decidedly concave.

The type, U.S.N.M. no. 205039, was dredged by the *Albatross* at station 5044 off Yerimo Zaki, southeast Hokkaido, in 309 fathoms; bottom temperature, 32.1°F., on gray sand, coral and sand bottom. It has 8.5 whorls remaining and measures: Height, 92 mm; greater diameter, 30.6 mm; length of last whorl, 51.1 mm.

U.S.N.M. no. 205036 contains 2 specimens dredged by the *Albatross* at station 5050 off Kinka San Light east of Sakhalin Island, in 266 fathoms; bottom temperature, 37.9°F., on dark gray sand and broken shell and Foraminifera bottom.

U.S.N.M. no. 205040 contains 1 specimen dredged by the *Albatross* at station 5045 off Yerimo Zaki southeast Hokkaido, in 359 fathoms; bottom temperature, 38°F., on brown mud and fine broken shell and coral sand bottom.

U.S.N.M. no. 205037 contains 1 specimen dredged by the *Albatross* at station 5051 off Kinka San Light, east of Sakhalin Island, in 399 fathoms; bottom temperature, 38.1°F., on dark gray sand and broken shell and Foraminifera bottom.

U.S.N.M. no. 342737 contains 1 specimen from the Hirasé collection (1402) taken at Rikuzen northeast of Honshu, Japan.

This species can readily be distinguished from all the others by its large size, gray coloration, and perfection of sculpture.

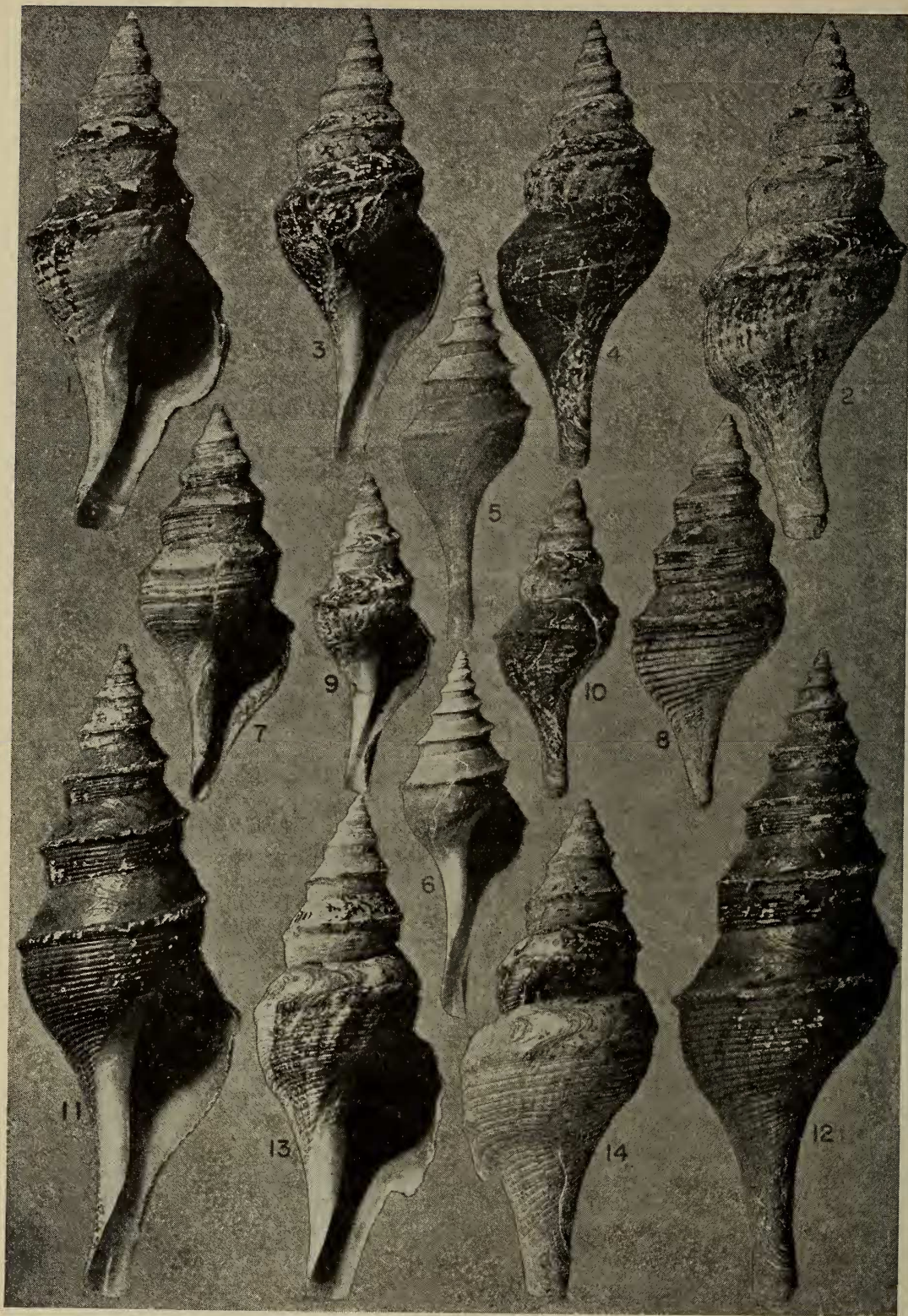
***Aforia hondoana* (Dall)**

Figs. 7, 8

1925. *Turricula (Surcula) hondoana* Dall, Proc. U. S. Nat. Mus. 66: 29-30, pl. 31, fig. 6.

Shell of medium size, turreted, covered by a gray periostracum. Interior of the aperture yellowish white. Nuclear whorls decollated. The postnuclear whorls bear a strong median keel, anterior to which the whorls are slopingly shouldered and marked by obsolete microscopic spiral striations. The keel bears 3 rather strong spiral threads. Anterior to the keel the whorls are marked by 6 very strong spiral





FIGS. 1-14.—West Pacific species of the genus *Aforia*. 1, 2, *A. okhotskensis*, n. sp.; 3, 4, *A. sakhalinensis*, n. sp.; 5, 6, *A. japonica* (Dall); 7, 8, *A. hondoana* (Dall); 9, 10, *A. chosenensis*, n. sp.; 11, 12, *A. diomedea*, n. sp.; 13, 14, *A. insignis* (Jeffreys). All about  $\times 1\frac{1}{2}$ .



cords which are separated by deep grooves not quite as wide as the cords. The base is well rounded and bears 7 very strong spiral cords also separated by deeply incised grooves. The columella is moderately long and bears 18 spiral cords which become progressively finer anteriorly. Aperture pear-shaped. The posterior sinus falls on the shoulder and is deep, broad, and rounded at base. Anterior to the keel the outer lip is protracted and rendered sinuous by the external sculpture. The inner lip is covered with a thick callus which somewhat covers the parietal wall.

The type, U.S.N.M. no. 111052, was dredged by the *Albatross* at station 5087 in Sagami Bay off Hondo, Japan, in 614 fathoms on mud bottom; bottom temperature 37.5°F. It has 6.5 whorls remaining and measures: Height, 56.2 mm; greater diameter, 21.5 mm; length of last whorl, 31.4 mm.

This species in general shape and sculpture most nearly resembles *A. insignis* from which its much smaller size and much stronger spiral sculpture will readily distinguish it.

#### *Aforia insignis* (Jeffreys)

Figs. 13, 14

1883. *Pleurotoma insignis* Jeffreys, Ann. Mag. Nat. Hist. 1883: 119-120.

Shell large, turreted. The patches of periostracum remaining show this to have been reddish brown. The interior of the aperture is ochre yellow. Nuclear whorls decollated. The postnuclear whorls are marked by a strong median keel which bears 5 fine spiral threads. Anterior to this keel the whorls are well rounded and marked by decidedly sinuous incremental lines which show that the posterior sinus is deep and broad. Anterior to the keel are 2 slender spiral threads equaling those on the keel in strength. This area is impressed and forms a slight groove. Anterior to this the whorls are marked by 7 spiral cords which are of somewhat varying strength and which are separated by deeply impressed narrow grooves. The base is well rounded and also bears 7 spiral cords equaling those of the spire in strength. Some of these are marked medially by a fine incised spiral line. The columella is long and bears 18 spiral cords which are of subequal strength. The axial sculpture consists of incremental lines only which are rendered decidedly sigmoid due to the deep posterior sinus. In the

specimen described, the last portion of the last whorl embracing the anterior 4 spiral cords, becomes somewhat folded and projects at the peristome as a slight claw. Aperture pear-shaped. Outer lip with a deep broad sinus on the shoulder, protracted anterior to the keel, and rendered somewhat sinuous by the external sculpture. The inner lip is covered with a thick callus, which extends over the parietal wall.

The specimen described and figured, U.S. N.M. no. 190815, comes from the Jeffreys collection and is one of 10 collected on the Vega Expedition in the Icy Sea of Siberia. It was used as the basis for Jeffreys' description and may therefore be considered the type of the species. It has 7.5 whorls remaining and measures: Height, 72.4 mm; greater diameter, 27.8 mm; length of last whorl, 41.5 mm.

In the elements of sculpture it most nearly resembles *A. hondoana*, from which, however, its larger size and less strong spiral sculpture will readily distinguish it.

#### *Aforia okhotskensis*, n. sp.

Figs. 1, 2

Shell large, turreted, interior pale buff, exterior covered by a thin gray periostracum, which is eroded in most part. A strong median spiral keel almost midway between summit and suture is present. Posterior to this keel the surface is marked by incremental lines and spiral lirations about as strong as the incremental lines. The anal sinus falls a little nearer the keel than the summit. Anterior to the keel the last whorl is rough and marked by deeply incised grooves which leave broad, rather rough, flattened spaces between them. Of these grooves, 8 are present between the keel and the insertion of the columella, the one bordering the keel being the deepest. On some of the spaces between these deep grooves there are indications of a median, secondary, less strong groove, while the keel itself is marked by finer spiral threads. The rather protracted columella is marked by 8 deeply impressed, spiral grooves which separate spaces about as wide as those on the base. In the anterior portion of the columella they seem to disappear. In addition to this, the columella and base are marked by strong incremental lines. In the type there is a secondary spiral ridge about as far anterior to the keel as that is from the summit, which corresponds to a secondary notch in the outer lip.

Aperture very elongate pear-shaped with the anal sinus deeply incised. Anterior to this the outer lip is protracted; the inner lip is decidedly sigmoid, while the left outline of the base and columella is decidedly concave.

The type, U.S.N.M. no. 205042, was dredged by the *Albatross* at station 5020 off the east coast of Sakhalin Island near Cape Patience, Okhotsk Sea, in 73 fathoms; bottom temperature, 30.9°F., on green mud, sand, and pebbly bottom. It has 7.5 whorls remaining and measures: Height, 73.8 mm; greater diameter, 28.5 mm; length of last whorl, 43 mm.

U.S.N.M. no. 205044 contains a young specimen dredged by the *Albatross* at station 5005 in Aniwa Bay on the east side of Sakhalin Island, Okhotsk Sea, in 42 fathoms; bottom temperature, 42°F., on green mud and fine gray sand bottom.

This species most nearly resembles *A. insignis* from which it can be distinguished by its much coarser spiral sculpture.

***Aforia sakhalinensis*, n. sp.**

Figs. 3, 4

Shell turreted, covered with a thin pale buff periostracum. Interior of aperture with an ochre flush. The whorls bear a strong median keel, anterior to which they are covered by fine microscopic hair lines and strongly sigmoid incremental lines of about the same strength, which follow the outline of the anal sinus. The anterior termination of the keel consists of a deeply impressed groove. The keel itself is crossed by fine spiral lines. Anterior to this groove the whorls are crossed by 14 incised grooves, which vary from mere lines to rather broad flat channels. The grooves and flattened spaces between them are crossed by rather strong incremental lines, which in the broad grooves assume the strength of hair lines. The columella is also marked by spiral grooves, of which 15 are present. The spaces enclosed by these are more rounded than those on the base, the axial incremental lines being of the same strength. On the extreme tip of the columella the spiral sculpture gradually fades out. Aperture elongate-pyriform; outer lip with a deep sinus whose greatest depth is a little nearer the keel than the summit of the whorls. The outer lip is protracted anteriorly to the keel. The inner lip is decidedly sinuous and covers the columella and parietal wall as a smooth re-

sorption area. The left outline of the base and columella is decidedly concave.

The type, U.S.N.M. no. 573613, was dredged by the *Albatross* at station 5051 off Kinka San Light east of Sakhalin Island in 399 fathoms; bottom temperature, 38.1°F., on dark gray sand and broken shell and Foraminifera bottom. It has 7.5 whorls remaining and measures: Height, 63.8 mm; greater diameter, 24 mm; length of last whorl, 36.3 mm.

U.S.N.M. no. 573614 contains a young specimen dredged by the *Albatross* at station 5050 off Kinka San Light east of Sakhalin Island, in 266 fathoms; bottom temperature, 37.9°F., on dark gray sand and broken shell and Foraminifera bottom.

This species most nearly resembles *A. chosenensis* but can readily be distinguished from that by its less strong basal sculpture and larger size.

***Aforia chosenensis*, n. sp.**

Figs. 9, 10

Shell small, turreted, the exterior covered with a grayish buff, thin periostracum. Interior of the aperture pale buff. The whorls bear a strong, decidedly elevated, median keel, posterior to which the slightly concave surface is marked by decidedly sigmoid lines of growth and microscopic spiral striations. Anterior to the keel the shell and the base and columella are marked by deeply incised, rather broad grooves which are a little more distantly spaced immediately below the keel than on the rest of the shell. These grooves enclose almost flattened areas which are a little narrower near the keel than on the rest of the surface. Eleven of these are present between the keel and the insertion of the columella, and 12 more on the columella where they gradually grow weaker anteriorly. In addition to this, the entire surface is marked by fine microscopic spiral striations and lines of growth. The latter appear almost as hair lines in the deep grooves. The keel itself is marked by fine spiral threads. The base of the last whorl and columella are decidedly concave on the left side. Aperture rather narrow, very elongate pear-shaped with a deep sinus a little anterior to the middle above the shoulder. The outer lip is protracted anterior to the keel and rendered somewhat sinuous by the external sculpture. The inner

lip is clongate-sigmoid. The columella is excavated into a smooth surface which also extends over the parietal wall.

The type, U.S.N.M. 205043, was collected by the *Albatross* at station 4860 off Cape Clonard, southeast coast of Chosen, Japan Sea, in 122 fathoms on gray mud bottom; bottom

temperature 34.1°F. It has 6 whorls remaining and measures: Height, 45.5 mm; greater diameter, 18 mm; length of last whorl, 27.8 mm. U.S.N.M. no. 573615 contains another specimen from the same station.

The small size will readily distinguish this from the other Japanese members.

ZOOLOGY.—*On the oligochaete genus Syngenodrilus and its taxonomic relationships.*<sup>1</sup> G. E. GATES, Judson College, Rangoon, Burma. (Communicated by WALDO L. SCHMITT.)

The oligochaete *Syngenodrilus lamuensis* Smith and Green, 1919, from Mkonumbi near Lamu on the coast of British East Africa, is known only from the original description of a single specimen. This "remarkable" species is of especial interest because of a peculiar combination of characteristics: septa 9/10–10/11 combined, 11/12 united either with 9/10–10/11 or 12/13; pregonadic gizzards, intestinal origin in region of xii–xiii; paired testis sacs (containing hearts and nephridia) in x–xi, numerous small seminal vesicles, one pair of larger, elongated seminal vesicles extending posteriorly within the ovisacs to xx, three pairs of prostates none of which are associated with the male genital ducts. *Syngenodrilus* was placed by its authors in the Asiatic family Moniligastridae primarily "because of the various important characteristics in which it is allied with *Desmogaster*" but probably as much because of the one-cell-layered clitellum and yolky ova supposedly characteristic of the Moniligastridae alone among Megadrili. Differences from other Moniligastridae were

recognized as sufficient to require division of the family into two subfamilies, the Moniligastrinae and Syngenodrilinae, the latter containing only *Syngenodrilus*. This classification was accepted by Michaelsen<sup>2</sup> and Stephenson, apparently without really critical examination. The necessity for such examination was recognized several years ago and a discussion of the problem was prepared for publication. There was, however, so much uncertainty with regard to a number of structures of taxonomic importance that it seemed advisable to postpone consideration of the problem until the type material could be studied. Although a sabbatical leave has permitted study of the original material, a considerable proportion of the uncertainty can not yet be resolved except as regards moniligastrid relationships.

The author's thanks are due to Prof. R. C. Osburn and the authorities of the Ohio State University for the courtesies of the Department of Zoology during the winter of 1940–41, and also to Dr. Waldo L. Schmitt, of the United States National Museum, for the opportunity afforded of examining the type material of *Syngenodrilus*.

*Syngenodrilus lamuensis* Smith and Green

1919. *Syngenodrilus lamuensis* F. Smith and B. R. Green, Proc. U. S. Nat. Mus. 55: 145–153, figs. 1–8.

1930. *Syngenodrilus lamuensis*, J. Stephenson, The Oligochaeta, p. 813 (vide also pp. 339, 671, 688, 696–697, 716, and 808–811).

<sup>2</sup> Michaelsen (1928) placed *Syngenodrilus* in a separate family, the Syngenodrilidae, distinct from but supposedly closely related to the Moniligastridae.

<sup>1</sup> In the collections of the U. S. National Museum is the unique type of an earthworm collected near Lamu on the eastern coast of British East Africa by William Astor Chanler in 1892 and described by Frank Smith and Bessie R. Green in the Proceedings of the U. S. National Museum, vol. 55, pp. 145–153, 1919, as a new genus and new species. Its taxonomic relationships have long intrigued students of the oligochaetes and as a result the type material has been critically re-examined in recent years by two specialists. The results of their observations are set forth in two papers, this one by Dr. G. E. Gates of Judson College, Rangoon, Burma, and the one immediately following by Dr. Grace E. Piekford, of the Osborn Zoological and Bingham Oceanographic Laboratories, Yale University.—W. L. SCHMITT. Received October 24, 1945.